

PATENT ABSTRACTS OF JAPAN

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(54) SOLDER ALLOY AND SOLDERING METHOD USING THE SAME

(57)Abstract:

PURPOSE: To provide a solder alloy formulated to satisfy the conditions regarded to be necessary at the time of, for example, soldering, without using lead which adversely affects environment, etc.

CONSTITUTION: This solder alloy contains 3 to 12wt.% zinc and consisting of the balance substantially tin and the content of oxygen therein is ≤ 100 ppm. This solder alloy otherwise contains 3 to 12wt.% zinc and ≤ 3 wt.% at least one kind selected from antimony, indium, gold, silver and copper and consists of the balance substantially tin and the content of oxygen is specified to ≤ 100 ppm.

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[0070]
[0016]

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Notes:

1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

[Claim(s)]

[Claim 1] Zinc 3 to 12 weight % Solder characterized by an oxygen content being 100 ppm or less by containing and the remainder consisting of tin substantially.

[Claim 2] Zinc 3 to 12 weight % It is as being chosen out of antimony, indium, gold, silver, and copper that it is few. One sort 3 weight % Solder characterized by an oxygen content being 100 ppm or less by containing below and the remainder consisting of tin substantially.

[Claim 3] The soldering method which is the soldering method using a solder according to claim 1 or 2, and is characterized by performing a soldered joint in a non-oxidizing atmosphere using said solder.

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention relates to a solder with high environmental safety, and the soldering method using it.

[0002]

[Description of the Prior Art] From the former, the solder of points, like a fusing point is low to the soldered joint in various instruments, and wettability is good for it also in an oxidizing atmosphere to a lead-tin system is used abundantly.

[0003] By the way, since lead has toxicity, regulation is made about the operation treating the alloy containing lead and it, and there is almost no outbreak of lead poisoning etc. However, it is being

begun to regard the rise of interest to the latest environmental destruction as questionable also about the disposal treatment of the various instruments using the solder containing lead, especially an electrical and electric equipment.

[0004] That is, as for the waste electrical and electric equipment which uses so much the solder containing lead, it was common conventionally like usual industrial waste or domestic wastes to mainly have reclaimed land and to have processed. However, if it continues processing the waste electrical and electric equipment which uses so much the solder containing lead by reclamation etc. as it is, it is apprehensive about having an adverse effect to environment, a living thing, etc. according to elution of the lead component which exists in a waste electrical and electric equipment.

[0005] Since it is such, when processing the waste electrical and electric equipment which uses so much the solder containing lead, it is progressing in the direction which obliges it to process after collecting lead. However, under the present circumstances, since there is a possibility that the technique of collecting lead from a waste electrical and electric equipment etc. effectively and easily may not be found out, and leaden recovery cost may cause buildup of product cost, development of the solder which does not use lead is desired strongly.

[0006] Although a part of thing which used tin as the base, for example and carried out compound addition of antimony, silver, germanium, the titanium, etc. at this as a solder which does not use lead which was mentioned above is put in practical use [these] like a lead-tin system solder for a special application It adds to characteristics, such as excelling in wettability by the solder which can be applied to very general soldering, i.e., the low-melt point point mentioned above. Under the present circumstances, the solder which can be applied to a reflow solder process etc. and which satisfies all the conditions of reacting with a base material and forming neither a weak compound nor an embrittlement layer is not found out.

[0007]

[Problem to be solved by the invention] Since it is progressing in the direction which obliges it to process after collecting lead when processing the waste electrical and electric equipment which uses so much the solder containing lead, as mentioned above, development of the solder which does not use the lead which has an adverse effect to environment etc. is desired. Although the solder which does not use lead is put in practical use partly, soldering nature, weatherability, etc. which are equal to a lead-tin system solder are not realized.

[0008] Since it is such, the solder which has soldering nature which does not have an adverse effect to environment etc. and is equal to a lead-tin system solder, weatherability, etc. is called for strongly.

[0009] This invention was made in order to cope with such a technical problem, and it aims at offering the solder to which the conditions needed, for example when soldering were satisfied, and the soldering method using it, without using the lead which has an adverse effect to environment etc.

[0010]

[Means for Solving the Problem and its Function] The solder of this invention is zinc. 3 to 12 weight % Contain and the remainder consists of tin substantially. that an oxygen content is 100 ppm or less

(Claim 1) or zinc 3 to 12 weight % It is as being chosen out of antimony, indium, gold, silver, and copper that it is few. It is 3 weight % about one sort. It contains below, the remainder consists of tin substantially, and it is characterized by an oxygen content being 100 ppm or less (Claim 2).

[0011] Moreover, the soldering method of this invention is the soldering method using the solder of above-mentioned this invention, and is characterized by performing a soldered joint in a non-oxidizing atmosphere using said solder.

[0012] Characteristics required of a solder here, it excels in (1) wettability, (2) Can solder at the temperature which does not do heat damage etc. to the instrument which carries out a soldered joint, namely, a fusing point is 473K order, (3) Form neither a weak intermetallic compound nor an embrittlement layer by a reaction with a base material, (4) Supplying forms (a paste, powder, etc.) applicable to automation can be taken, It is that the oxide of the metal component contained in (5) solders does not serve as a generation cause of the defect of poor wet, void, a bridge, etc. In order to make melting solder flow into a thin gap and to perform junction to a base material in the soldered joint of an electrical and electric equipment especially, the surface tension of a solder, viscosity, flowability, etc. are important. Although the conventional lead-tin system solder has been used abundantly as what satisfies well conditions which were mentioned above, it has the serious defect of having an adverse effect to environment etc. as mentioned above.

[0013] On the other hand, it is zinc in the solder of this invention, i.e., tin, at least. 3 to 12 weight % [the alloy added in the range] Since the safety of each component, such as zinc, is high while lead is not included, most characteristics required of the solder which did not have an adverse effect and was mentioned above to environment etc. are satisfied.

[0014] That is, as shown in drawing 1 , zinc and tin are all the rate dissolution, and in order to alloy without making a deposit in any mixing ratio, good soldered-joint nature is obtained. And it is especially zinc. 3 to 12 weight % The fusing point is as low as 493K or less, for example, the zinc-tin alloy contained in the range is zinc. 9 weight % In the zinc-tin alloy to contain, the fusing point has 471K and the low-melt point point of being suitable for soldering. The addition of the zinc to tin 3 weight % Even if it is the following, it is 12 weight %. Even if it exceeds, the low-melt point point needed for a solder by each is no longer acquired. Generally, if the soldering temperature of an electrical and electric equipment is lowered 10 degrees, it is the life of electronic parts. Since it is said that it doubles, the formation of a low-melt point point of a solder is dramatically effective.

[0015] Moreover, since the zinc-tin alloys used as a solder by this invention are all the rate dissolution alloys with tin which is excellent in conductivity, the wettability over the copper which has the almost same characteristic as a tin simple substance, and is used abundantly as conductors, such as a printed plate board, of characteristics, such as the conductivity, is also high. Furthermore, even if it compares zinc with other metals, it can be inexpensive offered to the same extent with a lead-tin system solder as a solder inexpensive used for an electrical and electric equipment variously so much.

[0016] It is that it is few as being chosen out of antimony, indium, gold, silver, and copper as the

solder which uses tin of this invention as a principal component in addition to the zinc mentioned above. One sort of elements You may add in 3 or less weight % of the range. These are these elements although it contributes to the further formation of a low-melt point point of a solder, or a betterment of wettability. 3 weight % If it exceeds and adds, a solder appearance will worsen (luster is lost). Antimony and copper are elements contributed to a betterment of the wettability of the solder of this invention among the alloying elements mentioned above, and indium, gold, and silver are elements contributed to low-melt point point-ization of the solder of this invention.

[0017] Moreover, since there is a possibility that there may be no problem in particular or especially oxygen may make a solder weak even if the solder of this invention contains a little inescapable impurities, such as oxygen, nitrogen, and hydrogen, for example, the content may be 100 ppm or less.

[0018] By the way, although the zinc which is the main architecture element oxidizes in a soldered joint and the solder which uses as a principal component tin of this invention mentioned above has a difficulty of ****, this is solvable by soldering in non-oxidizing atmospheres, such as nitrogen and argon. The soldering method of this invention is the method of carrying out a soldered joint in a non-oxidizing atmosphere using the solder of this invention in this way, and can prevent the development of the poor wet by oxidation of the solder of this invention, an electric faulty connection, etc. by this.

[0019] Moreover, in the soldering method of this invention, you may carry out like the usual soldered joint, adding a supersonic wave.

[0020] In addition, it can be used effective in soldering of various electrical and electric equipments which were mentioned above, and also the solder of this invention can be used for the application the lead-tin system alloy was used [application] conventionally and to which it has been, for example, a fuse etc., using the characteristic to be a low-melt point point while it is excellent in environmental safety.

[0021]

[Working example] The example of this invention is explained hereafter.

[0022] an example 1-8 and a comparative example 1 -- each solder which shows alloy composition in Table 1, respectively was dissolved and manufactured first. The fusing point of each [these] solder is shown in Table 1.

[0023] Next, it soldered to the printed plate board (copper clad laminate) in which electronic parts were carried using each solder mentioned above, pouring nitrogen locally. in addition -- each soldering temperature receives the fusing point of each alloy -- 10-30 -- it was considered as a temperature high [about K]. And while checking wettability on the occasion of the above-mentioned soldering, the weatherability after soldering was evaluated. These results are collectively shown in Table 1 with the identification result of the safety of each solder.

[0024] In addition, the comparative example 1 in front is the conventional lead-tin system solder, and is hung up as a foundation of assessment of the solder of the above-mentioned example.

[0025]

[Table 1]

	合金組成（重量％）			融点 （ppm）	融点 （K）	特性評価結果		
	Zn	他の成分	Sn			ぬれ性	耐候性	安全性
実施例 1	9	—	残部	20	471	良好	良好	良好
“ 2	5	—	”	32	486	”	”	”
“ 3	6	Sb:2	”	28	484	”	”	”
“ 4	10	In:2	”	18	484	”	”	”
“ 5	8	Ag:3	”	42	484	”	”	”
“ 6	9	Au:1	”	38	469	”	”	”
“ 7	9	Cu:3	”	24	549	”	”	”
“ 8	5	In:1, Ag:3	”	55	473	”	”	”
比較例 1	—	Pb:37	”	121	456	”	”	不良

The solder of each example is good about wettability as well as the conventional lead-tin system solder, and has the outstanding soldering nature while it has a low-melt point point, so that clearly from Table 1. Moreover, change of characteristics, such as embrittlement, is not looked at by prolonged activity, either, but it has the outstanding weatherability like the conventional lead-tin system solder. On the other hand, although the lead-tin system solder is excellent in wettability or weatherability while having a low-melt point point as used so much from the former, leaden toxicity poses a problem also to environment etc.

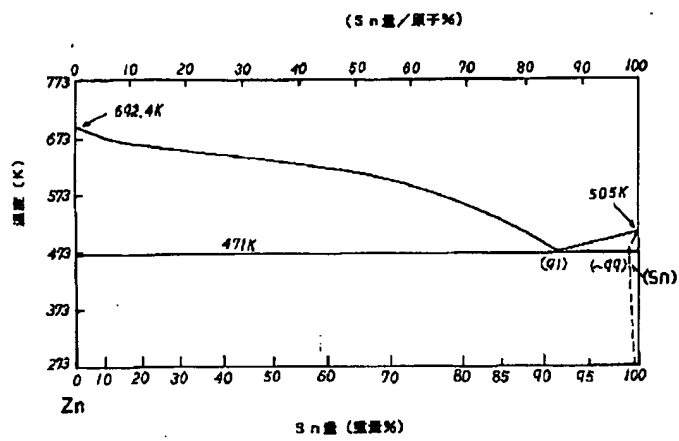
[0026]

[Effect of the Invention] As explained above, the solder of this invention is a low-melt point point, and it is excellent [solder] in environmental safety etc., without including harmful lead while excelling in wettability or weatherability. Therefore, it becomes possible to offer inexpensive the solder to which the conditions which do not have an adverse effect to environment etc. and are needed when soldering were satisfied. Moreover, according to the soldering method of this invention, a good soldered joint is realizable using such a solder.

[Brief Description of the Drawings]

[Drawing 1] It is the phase diagram of the binary alloy of zinc and tin.

[Drawing 1]



[Translation done.]